US009348669B2

(12) **United States Patent**
Knichel et al.

(10) **Patent No.: US 9,348,669 B2**
(45) **Date of Patent: May 24, 2016**

(54) **USER INTERFACE FRAMEWORK**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 48 days.

(21) Appl. No.: **14/101,305**

(22) Filed: **Dec. 9, 2013**

(65) **Prior Publication Data**

US 2015/0160987 A1 Jun. 11, 2015

(51) **Int. Cl.**
G06F 9/54 (2006.01)
G06F 9/44 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 9/542*** (2013.01); ***G06F 9/4443*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 9/542; G06F 9/4443
See application file for complete search history.

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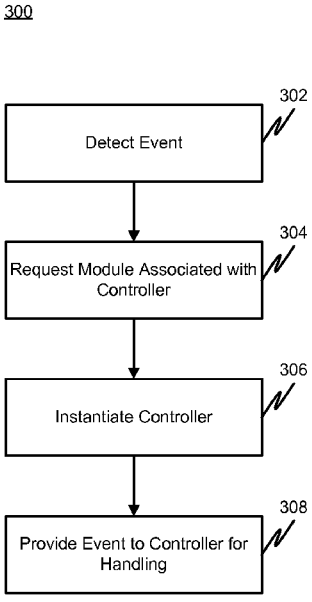
Primary Examiner — Syed Roni

(57) **ABSTRACT**

Systems, methods and computer readable media for user interface frameworks are disclosed. In some implementations, the method can include detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller. The method can also include requesting a module associated with the controller and instantiating the controller. The method can further include providing the event to the controller.

17 Claims, 4 Drawing Sheets



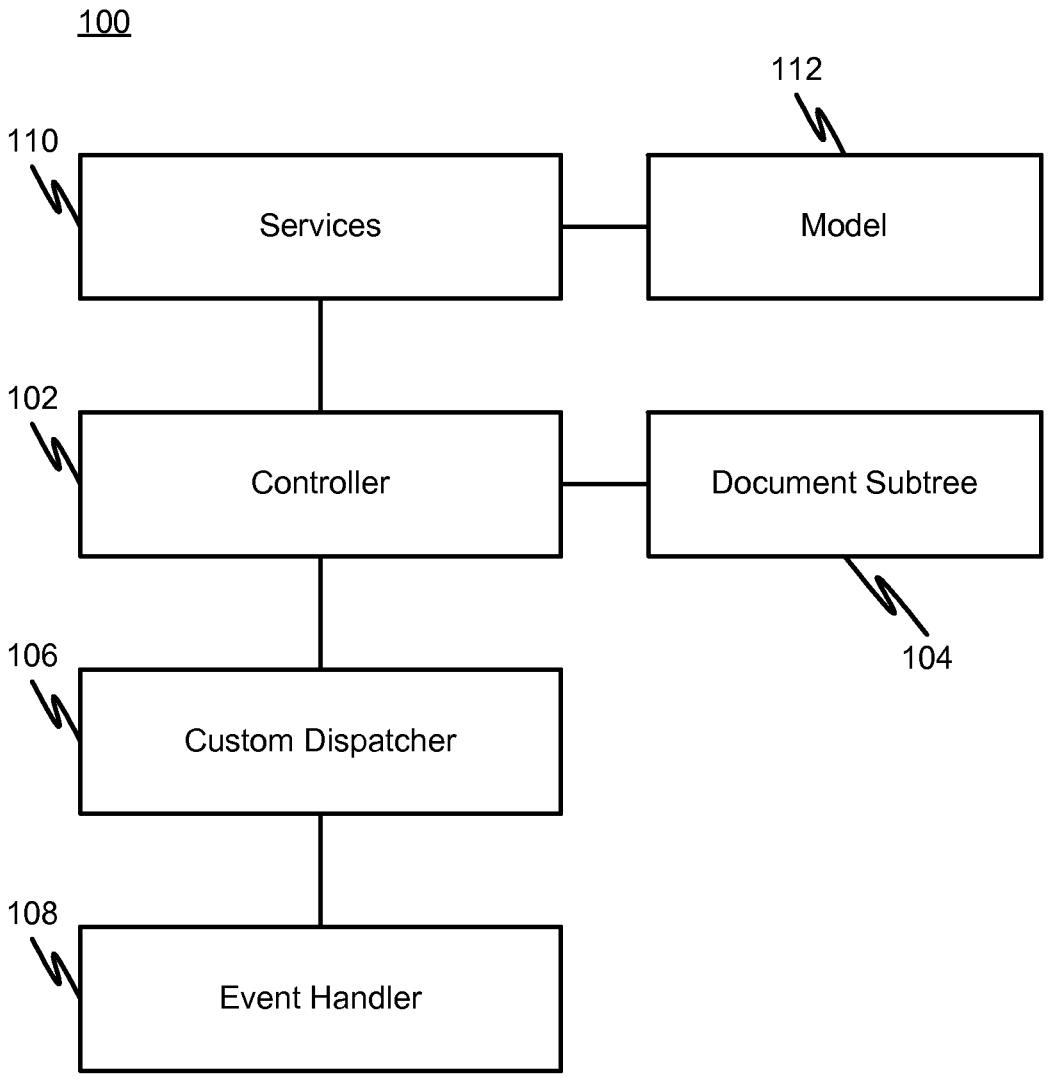

100
112
110
Services
Model
102
Controller
Document Subtree
104
106
Custom Dispatcher
108
Event Handler

FIG. 1

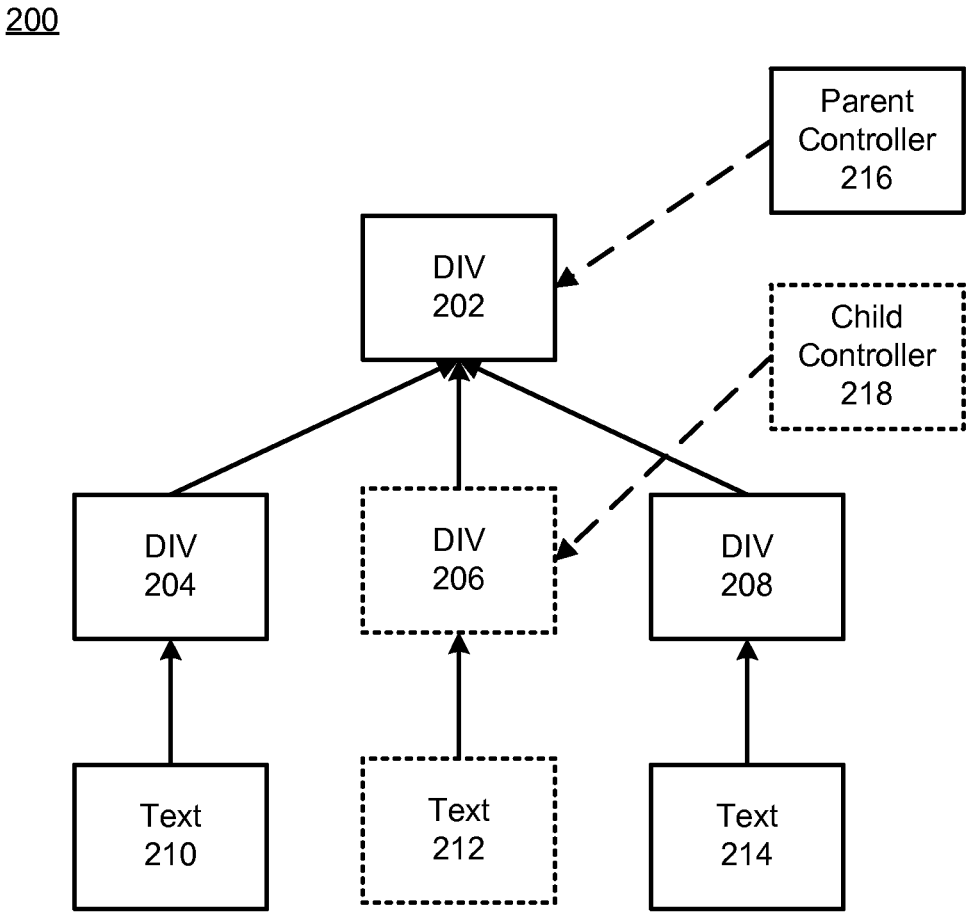

200
Parent Controller 216
DIV 202
Child Controller 218
DIV 204
DIV 206
DIV 208
Text 210
Text 212
Text 214

FIG. 2

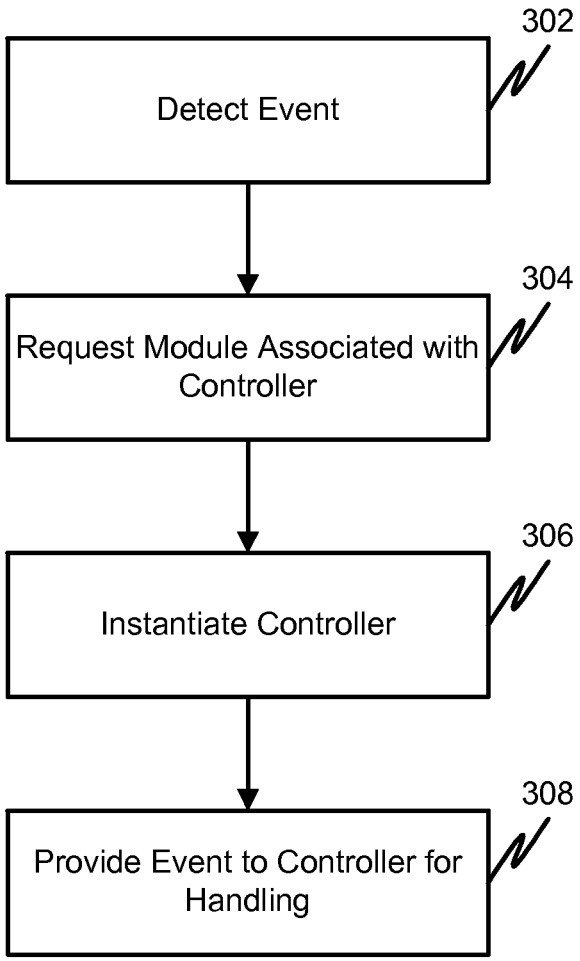

300
302
Detect Event
304
Request Module Associated with Controller
306
Instantiate Controller
308
Provide Event to Controller for Handling

FIG. 3

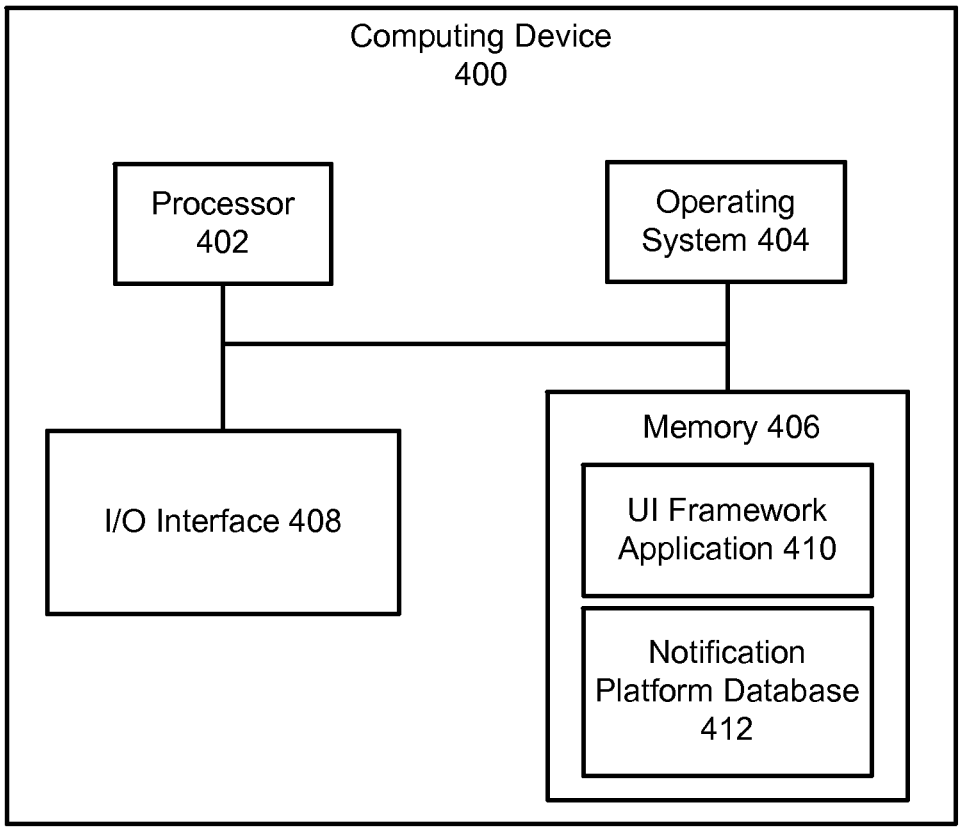

Computing Device
400
Processor
402
Operating
System 404
I/O Interface 408
Memory 406
UI Framework
Application 410
Notification
Platform Database
412

FIG. 4

USER INTERFACE FRAMEWORK

FIELD

Some implementations relate generally to user interface frameworks and, more particularly, to methods, systems and computer readable media for document object model (DOM) user interface frameworks.

BACKGROUND

Some user interface (UI) models include, and may require, the use of UI software components for both rendering the UI and handling user interaction with the UI. Also, in some UI models, software components associated with the UI may be created and initialized at load time (e.g., at the load time of a web page), which may cause the page to load slowly and use memory for components that may not be needed when the page first loads (or may not be needed at all) depending on user interaction with the UI. Further, some UI models may require code to set up elements, create objects and listen for events. Such code can increase the page size of files, reduce the readability of the page source code (e.g., HTML) and may increase the load time of a page having code.

SUMMARY

Some implementations can include a method. In some implementations, the method can include detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller. The method can also include requesting a module associated with the controller and instantiating the controller. The method can further include providing the event to the controller.

The controller can be associated with the document object model node via a declaration in a mark-up language portion of the document model object code containing the node. Instantiating the controller can include automatically instantiating the controller in response to the first occurrence of the event.

The method can also include specifying the controller as optional, wherein when the controller is specified as optional and cannot be located by the user interface framework; the user interface framework does not raise an error based on the controller not being found. The controller can include one or more arguments passed to the controller when the controller is called. The arguments can include one or more of a statement in a declaration of the controller within code declaring the document object model node; a shared object within a data model accessible by controllers within the document object model; and a context.

The document object model node can include an attribute defining the module and specifying that the module be loaded prior to instantiating the controller. An instance of the controller can be cached in a root node of the controller. The method can further include removing the controller instance when the document object model node instance is destroyed.

Some implementations can include a system having one or more processors configured to perform operations. The operations can include detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller. The operations can also include requesting a module associated with the controller. The operations can further include instantiating the controller and providing the event to the controller.

The controller can be associated with the document object model node via a declaration in a mark-up language portion of the document model object code containing the node. Instantiating the controller can include automatically instantiating the controller in response to the first occurrence of the event. The operations can further comprise specifying the controller as optional, wherein when the controller is specified as optional and cannot be located by the user interface framework, the user interface framework does not raise an error based on the controller not being found.

The controller can include one or more arguments passed to the controller when the controller is called, the arguments can include one or more of a statement in a declaration of the controller within code declaring the document object model node, a shared object within a data model accessible by controllers within the document object model, and a context. The document object model node includes an attribute defining the module and specifying that the module be loaded prior to instantiating the controller. The operations can further comprise removing the controller instance when the document object model node is destroyed.

Some implementations can include a nontransitory computer readable medium having software instructions stored there on that, when executed by a processor, cause the processor to perform operations. The operations can include detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller. The operations can also include requesting a module associated with the controller and instantiating the controller. The operations can further include providing the event to the controller.

The controller can be associated with the document object model node via a declaration in a mark-up language portion of the document model object code containing the node. Instantiating the controller can include automatically instantiating the controller in response to the first occurrence of the event.

The document object model node can include an attribute defining the module and specifying that the module be loaded prior to instantiating the controller. The operations can further comprise removing the controller instance when the document object model node is destroyed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an example system for user interface frameworks in accordance with some implementations.

FIG. **2** is a flow chart for user interface frameworks in accordance with some implementations.

FIG. **3** is a flow chart showing an example method for user interface frameworks in accordance with some implementations.

FIG. **4** is a diagram fan example computing device configured for user interface frameworks in accordance with some implementations.

DETAILED DESCRIPTION

Systems, methods and computer readable media for user interface frameworks are disclosed. In general, in some implementations, the systems, methods and computer readable media can include a UI framework written in a language, such as Javascript or the like that compatible with web page mark-up languages such as hypertext mark-up language (HTML), extensible mark-up language (XML) or the like.

Some implementations can include a template-rendered UI in which the UI controllers are responsible for handling user

interaction, while rendering is performed via templates. Also, the UI controllers can be configured to work with both server- and client-rendered HTML or other mark-up languages.

The UI framework can include controllers that are instantiated by declaring them in the template using a mark-up language or scripting language attribute such as controller or the like. Interfaces connecting controllers can be declaratively specified as well.

Also, the UI controllers can be configured to handle asynchronous actions such as user events, late-loaded services, and server data requests. The framework can include a dependency-injection style of programming which permits a controller (or even a method of a controller) to specify what needs to happen before that controller is invoked. Thus, some of the complexities typically associated with asynchronous programming are absorbed into the framework.

UI controllers as described herein do not have to be initialized or even created in order to listen for events. A controller can be constructed automatically the first time an event is sent to it. Thus, the creation and/or initialization of a controller does not have to occur at page load time, allowing for a smaller initial download size as compared to some conventional UI frameworks. The UI framework as described herein may be particularly well suited to web applications having many complex pages that display large amounts of content.

The sometimes complex relationships between objects can be specified declaratively in the document object model (DOM) code rather than being constructed imperatively at application startup time. The setup phase for controllers can happen as needed and "just in time."

FIG. **1** shows an example system **100** for user interface frameworks having a controller **102** that manages a document subtree **104** (e.g., a subtree of a DOM), handles UI events and communicates with a data model **112** exposed through services **110**. Alternatively, the controller **102** can communicate directly with the data model **112**. Also, the data model **112** can manage the document subtree **104**. The controller **102** and/or data model **112** can be implemented, for example, as a JavaScript object bound to an HTML subtree. Events that occur in the subtree may be handled by the controller **102**, specified through an event handler **108** via HTML attributes. A custom dispatcher **106** maps event handlers (e.g., **108**) to controllers (e.g., **102**), manages their lifecycle and calls methods on them.

A simple example of an HTML fragment having a controller declaration is shown below for illustration purposes:

```
<div>
  <div controller="foo.SampleController" data-userid="1234">
    <button action="click:handleClick">Click Me</button>
    <div jsname="status"></div>
  </div>
</div>
```

An example of a JavaScript corresponding to the above HTML fragment is shown below:

```
foo.SampleController = framework.Controller( )
foo.SampleController.prototype.handleClick =function( ) {
  this.element('status').text('clicked');
};
```

FIG. **2** shows a diagram of an example user interface framework environment **200** having a plurality of div elements, text elements and controllers. A parent controller **216** controls the subtrees for div **202**, div **204** and div **208**. A child controller **218** controls the DOM subtree of div **206**.

The controllers (e.g., **216** and **218**) are objects that manage subtrees of the DOM. The controller can be attached to a DOM element and is responsible for all the DOM nodes that are children of that element, except for portions that belong to a child controller.

Events that originate from within the DOM subtree may be handled by the controller. Events can be native browser events or application events coming from other controllers. When multiple controllers need to communicate and share data, the shared data can be placed into a separate data model object, which each controller has a reference to. The model object can contain business logic and can communicate with the server.

FIG. **3** is a flow chart showing an example method **300** for user interface frameworks in accordance with some implementations. Processing begins at **302**, where an event is detected from within a DOM node associated with a controller (e.g., via the declaration technique discussed herein). Events can include an event from a user interface element or an event from another controller. Processing continues to **304**.

At **304**, a module associated with the controller is requested. The module may be requested just prior to passing the event to the controller. Processing continues to **306**.

At **306**, the controller is instantiated and initialized. Processing continues to **308**.

At **308**, the event is provided to the controller for handing. It will be appreciated that **302-308** can be repeated in whole or in part in order to accomplish a contemplated UI task.

FIG. **4** is a diagram of an example computing device **400** that can be configured for providing and/or executing user interface frameworks in accordance with some implementations. The computing device **400** includes a processor **402**, operating system **404**, memory **406** and I/O interface **408**. The memory **406** can include a user interface framework application **410** and a database **412** (e.g., for storing names of components, controllers, events, data models or the like).

In operation, the processor **402** may execute the user interface framework application **410** stored in the memory **406**. The user interface framework application **410** can include software instructions that, when executed by the processor, cause the processor to perform operations for providing and/or executing a user interface framework in accordance with the present disclosure (e.g., the user interface framework application **410** can perform one or more of steps **302-308** described above and, in conjunction, can access the database **412**). The user interface framework application **410** can also operate in conjunction with the operating system **404**, and services, dispatchers, action handlers, events, document subtrees and data models (as shown in FIG. **1**).

The user interface framework computing device (e.g., **400**) can include, but is not limited to, a single processor system, a multi-processor system (co-located or distributed), a cloud computing system, or a combination of the above.

The client (or user) device(s) can include, but are not limited to, a desktop computer, a laptop computer, a portable computer, a tablet computing device, a smartphone, a feature phone, a personal digital assistant, a media player, televisions, an electronic book reader, an entertainment system of a vehicle or the like. Also, client/user devices can include wearable computing devices (e.g., glasses, watches and the like), furniture mounted computing devices and/or building mounted computing devices.

The user devices can be connected to a user interface framework server via a network. The network connecting user devices to the user interface framework server can be a

wired or wireless network, and can include, but is not limited to, a WiFi network, a local area network, a wide area network, the Internet, or a combination of the above.

The data storage, memory and/or computer readable medium can be a nontransitory medium such as a magnetic storage device (hard disk drive or the like), optical storage device (CD, DVD or the like), or electronic storage device (RAM, ROM, flash, or the like). The software instructions can also be contained in, and provided as, an electronic signal, for example in the form of software as a service (SaaS) delivered from a server (e.g., a distributed system and/or a cloud computing system).

Some implementations of the disclosed method, system, and computer readable media can be implemented in software (e.g., as a computer program product and/or nontransitory computer readable media having stored instructions user interface frameworks as described herein). The stored software instructions can be executed on a programmed general purpose computer, a special purpose computer, a microprocessor, or the like.

It is, therefore, apparent that there is provided, in accordance with the various example implementations disclosed herein, systems, methods and computer readable media for user interface frameworks.

While the disclosed subject matter has been described in conjunction with a number of implementations, it is evident that many alternatives, modifications and variations would be or are apparent to those of ordinary skill in the applicable arts. Accordingly, Applicants intend to embrace all such alternatives, modifications, equivalents and variations that are within the spirit and scope of the disclosed subject matter.

What is claimed is:

1. A method comprising:

detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller, wherein the document object model node includes an attribute defining a module and specifying that the module be loaded prior to instantiating the controller;

requesting the module associated with the controller;

instantiating the controller, wherein instantiating the controller includes automatically constructing the controller in response to a first occurrence of the event; and

providing the event to the controller.

2. The method of claim **1**, wherein the controller is associated with the document object model node via a declaration in a mark-up language portion of document model object code containing the node.

3. The method of claim **1**, further comprising specifying the controller as optional, wherein when the controller is specified as optional and cannot be located by the user interface framework, the user interface framework does not raise an error based on the controller not being found.

4. The method of claim **1**, wherein the controller can include one or more arguments passed to the controller when it is called, the arguments including one or more of:

a statement in a declaration of the controller within code declaring the document object model node;

a shared object within a data model accessible by controllers within the document object model; and

a context.

5. The method of claim **1**, wherein an instance of the controller is cached in a root node of the controller.

6. The method of claim **1**, further comprising removing an instance of the controller when the document object model node is destroyed.

7. The method of claim **1**, wherein the controller is declared in a template using a mark-up language or scripting language attribute.

8. A system comprising:

one or more processors configured to perform operations including:

detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller, wherein the document object model node includes an attribute defining a module and specifying that the module be loaded prior to instantiating the controller;

requesting the module associated with the controller;

instantiating the controller, wherein instantiating the controller includes automatically constructing the controller in response to a first occurrence of the event; and

providing the event to the controller.

9. The system of claim **8**, wherein the controller is associated with the document object model node via a declaration in a mark-up language portion of document model object code containing the node.

10. The system of claim **8**, wherein the operations further comprise specifying the controller as optional, wherein when the controller is specified as optional and cannot be located by the user interface framework, the user interface framework does not raise an error based on the controller not being found.

11. The system of claim **8**, wherein the controller can include one or more arguments passed to the controller when it is called, the arguments including one or more of:

a statement in a declaration of the controller within code declaring the document object model node;

a shared object within a data model accessible by controllers within the document object model; and

a context.

12. The system of claim **8**, wherein the operations further comprise removing a controller instance when the document object model node is destroyed.

13. The system of claim **8**, wherein the controller is declared in a template using a mark-up language or scripting language attribute.

14. A nontransitory computer readable medium having software instructions stored thereon that, when executed by a processor, cause the processor to perform operations comprising:

detecting, at a dispatcher within a user interface framework, an event emitted from a user interface element contained within a document object model node associated with a controller, wherein the document object model node includes an attribute defining a module and specifying that the module be loaded prior to instantiating the controller;

requesting the module associated with the controller;

instantiating the controller, wherein instantiating the controller includes automatically constructing the controller in response to a first occurrence of the event; and

providing the event to the controller.

15. The nontransitory computer readable medium of claim **14**, wherein the controller is associated with the document object model node via a declaration in a mark-up language portion of document model object code containing the node.

16. The nontransitory computer readable medium of claim **14**, wherein the operations further comprise removing an instance of the controller when the document object model node is destroyed.

17. The nontransitory computer readable medium of claim 14, wherein the controller is declared in a template using a mark-up language or scripting language attribute.

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